Africa RISING Ethiopian Highlands Feed and Forage Development Training Manual

Melkamu Bezabih [1], Aberra Adie [2] and Kindu Mekonnen[3]

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Through action research and development partnerships, Africa RISING is creating opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment.

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Introduction

Feed shortage and poor quality of available feeds are major factors that have constrained the livestock production sector in Ethiopia. The increasing human and livestock population has resulted in continuous natural resources degradation and decline in productivity. Moreover, drought and natural disasters like flooding becomes more frequent in many parts of the country. The expansion of croplands to meet the food demands makes the grazing lands to shrink continuously. Despite all these constraints, livestock plays a major role in the livelihood of most pastoralists and farmers by providing food to the family, supporting crop production and contributes to the national economy.

The government of Ethiopia, in its growth and transformation plan, has considered livestock as the main agenda of development and a driver of change. In this plan, the major intervention is transforming the feed supply and quality, in which cultivated forage production is the main target. On the other hand, the national Climate Resilient Green Economy (CRGE) strategy targets the reduction of greenhouse gas emissions from livestock through improved feeding and increased productivity. The main strategy is keeping crossbred animals and improved feeding through cultivation of forages. Similarly, the Livestock Master Plan (LMP) has also designed livestock development primarily with increased access to cultivated forage production.

Currently, the major feed sources for livestock are natural grazing lands and crop residues. The contribution of agro-industrial by products concentrate feeds and cultivated forage crops is minimal. Adoption of cultivated forage crops in the farming system is very low. The main reasons for this low adoption include lack of awareness, shortage of inputs, use of low producing animals, poor supply of seeds and planting materials.

Different species of cultivated forage crops have been evaluated for their various uses and their production in the different agro-ecologies of Ethiopia. These forage crops are broadly categorized as forage grasses, legumes and browses. With the current scenario of very critical feed shortage in Ethiopia, use of cultivated forage crops is not a choice but is a must. However, cultivation of forage crops, particularly by smallholder farmers, is feasible when various appropriate options of forage production strategies are practiced.

Forage cultivation niches

Cultivation of forage crops in arable lands

In small and medium scale market-oriented livestock producers especially, dairy producers need to cultivate forage crops in a conventional way. Depending on the number of animals and feed requirements farmers could decide the size of the farm to cultivate forage crops. Forage crops cultivated should primarily consider adaptability, productivity and quality.

In areas where communal grazing is practiced and if there is communal after-math grazing then forage crops cultivated should preferably be annuals like oats, vetch, lablab, Sudan grass, cowpea etc. Such forage crops should be grown in the normal cropping seasons usually under rainfed conditions, harvested and conserved as hay or silage. The produced forage should be properly conserved and fed to livestock in a well-planned way. On the other hand, cultivation of perennial forage crops may create difficulties to keep them during the offseason unless and otherwise it is fenced and well protected from free grazing livestock.

Forage crops can also be cultivated under irrigation where such areas are protected from livestock grazing. Under such conditions, highly productive annual and perennial forage crops can be cultivated and used either in a cut and carry or conserved and fed to animals.

Generally, when planning cultivation of forage crops, one needs to consider gathering information on the soil and production system and identify suitable and productive forage species to the area (annuals vs perennials, grasses vs legumes and mixtures)

Effective planning and targeting of cultivated forages can enable smallholders and commercial producers to get adequate feed year-round and most importantly farmers who do not have access to or the capacity to purchase concentrate feeds can get good quality feed with relatively cheaper prices in their vicinity.

Backyard forage cultivation

One of the strategies to produce a small scale but high-quality forage production is cultivation of forages in and around the backyards. Backyard of smallholder farmers are usually small but with high soil fertility. Farmers use the backyards for different purposes. They planted mostly perennial crops of high-value crops like spices, fruits and vegetables. However, farmers with productive animals can grow very high quality and a remarkable good quantity of forages in and around the backyards. In addition to this various forage crops could be planted along the fence lines and could provide multipurpose uses. It provides forages, serve as fence and wind protection. The forages to be grown in the backyards needs to be.

- Adaptable for the targeted agro-ecology
- High in quality in terms of animal preference and nutrients especially Crude proteins
- Highly productive per unit area
- Highly prolific with fast regrowth ability
- Very good compatibility with other guarded crops

- When planted along the fence lines browse trees and taller forages like elephant grass could be used

The availability of irrigation from different sources (rivers, shallow wells, boreholes, reservoirs etc) around the backyards would be an additional advantage. The water could be used as a supplemental irrigation during the dry season or when there is moisture stress to have fresh and quality feed supply throughout the year.

Forage production on soil and water conservation structures

The crop livestock mixed production systems are practiced dominantly in the highland and mountainous areas of Ethiopia. These areas were traditionally cultivated for hundreds of years. The human and livestock population was tripled during the last forty or so years, which creates a lot of pressure on land and natural resources. Currently, land degradation is a serious challenge in Ethiopia, which is also aggravated by climate variability and changes. In this regard, various efforts are going on nationally on natural resources conservation especially in the areas of water and soils. Forage crops have an important role in natural conservation practices. Using forages in conservation activities have the advantage of protecting the land from soil and water erosion and could also provide forage as feed source to livestock. These activities are widely practiced by the ministry of agriculture, ministry of natural resources and environmental protection and many other NGO engaged in agricultural development. Forages are planted on soil bands, gullies, enclosures, degraded grazing lands and sloppy areas to protect soil and water resources.

Such activities are widely implemented at community and individual levels. Communities have participated in communal lands, enclosures where the management of the outputs and the overall efficiency are low. On the other hand, individual farmers are making conservation structures on their arable lands, plant forage crops on conservation structures and farmers are benefited a lot from such activities.

The forage species to be used in the conservation structure could be selected based on their adaptability to the given agro-ecology. In the highland areas species well adapted to the highlands (cooler environment) could be used similarly well performing species in the mid and low altitude areas are pertinent in the warmer and hot areas (Table 1). In addition to their forage productivity and vegetative growth, forages for conservation practice need to have deep and fibrous roots to hold the soil firmly, bunch types of growth habit with numerous tillers, tolerant to trampling and possible grazing of animals, drought and moisture tolerant so that it can persist the longer dry season, and quickly responsive to small showers with fast growth.

Oat-vetch mixture forage

Description

Oat and vetch are annual forages, which—when grown using intercropping—provide a high biomass yield of good nutritional quality. While oat comes from the grass family, vetch is a leguminous forage. Consequently, oat-vetch mixture is a balanced feed in terms of energy and protein contents and has very high feed values for animals as green fodder or hay. Moreover, vetch potentially offers substantial improvements in terms of soil fertility through nitrogen fixation and serves as a weed and disease break when used in crop rotations.

Growth

- Oat and vetch are compatible when grown using intercropping and have a short growth cycle, ranging from 60–90 days before the forage can be used as feed.
- This feature enables farmers to effectively use available rain to produce good quality fodder in a short period of time and free up their land for other crops.
- The short growth cycle also makes these forage combinations suitable to be grown under irrigation.

Land preparation

- The land preparation for oat and vetch is like that needed for other crops. It needs to be plowed repeatedly, preparing a smooth plot, before the seeds can be sown.
- The land also needs to be well drained, as water logging has a significantly negative effect on yield rates.

Sowing

- Seed rates of 75 kg/ha for oats and 25 kg/ha for vetch are recommended with a high germination rate (above 90%). The seed rate can be increased to 90 kg/ha for oats and 30 kg/ha for vetch to provide allowance for low seed emergence.
- Both row planting and broadcasting may be used depending on the amount of land and the availability of labour. In case of row planting, the spacing between rows should be 15 cm and oat and vetch should be sown on alternate rows (i.e. oats on the first row, vetch on the second one, etc.). It is a good practice to divide the seeds between the total number of rows before starting to sow to make sure the distribution is even.
- When a broadcast method is used, the seeds need to be thoroughly mixed to ensure a uniform distribution of the two forages.

Harvesting

- The ideal moment for harvesting oat-vetch is when the forage has reached the bloom stage.
- The forage can be conserved in the form of hay or used as a green feed mixed with other locally available feed resources.

Benefits

The oat-vetch mixture provides high biomass yields (approximately 12 tonnes of dry matter per hectare) of good nutritional quality (crude protein of 15.5% and metabolizable energy of 10 MJ/kg of dry matter. The mixture provides a balanced diet in terms of protein and energy. The forage can be used as a very good supplement for lactating cows, fattening sheep or beef cattle. Mixing about 30% of the oat-vetch mixture with about 70% of locally available feeds, such as crop residues, improves utilization and animal productivity. Milk yields of lactating cows consuming crop residue-based diets have increased by more than 50% when supplemented daily with approximately 2 kg of dry matter of oat-vetch mixture.

Photo 1 . A farmer in Lemo district, southern Ethiopia harvesting oat-vetch mixture forage in his backyard for feeding to lactating cows (photo credit: ILRI/Kindu Mekonnen)

Tree Lucerne (Chamaecytices palmensis)

Description

Tree Lucerne (*Chamaecytices palmensis)* is one of the few leguminous fodder and fertilizer tree species that perform well in areas of high altitude. The plant fixes and adds nitrogen to the system, enhancing livestock, crop and soil productivity. Commonly referred to as tree lucerne or tagasaste, it is native to Spain and exotic species to Australia, Ethiopia, South Africa, Rwanda and New Zealand

Growing ecology

- Lucerne can grow in areas from 2,000–over 3,000 masl of the Ethiopian highlands.
- It requires from 350–1,600 mm of rainfall.
- The soil in which it is planted should be well drained.

Establishment of tree lucerne

- The identification of farmers interested in planting, managing and using tree lucerne is important.
- Seed sources: Seeds can be collected locally or sourced from suppliers.
- Seedling raising: Private, community and government nurseries are involved in this area of business.
- Seedling production systems include bare rooted and container systems.
- Seed treatment: Tree lucerne seeds require scarification or immersion in boiled water for one minute.
- Ensuring the compatibility of farmer planting niches needs supervision.
- A seedling size of more than 45 cm is preferable for planting.
- Seedlings require at least three months in the nursery.
- A planting hole of 30–40 cm deep is recommended to protect the tap roots from being harmed.
- It can be planted as a live fence, fodder lot, soil and water conservation structures, and boundary planting and intercropped with crops and vegetables.
- Lucerne trees should be planted at least 25 cm apart from each other.

Management of tree Lucerne

- Regularly spot weeding around the seedling.
- Fencing should be erected to protect the trees against incursion by livestock—trampling and browsing.
- The use of mulch/manure is recommended to help retain moisture in the soil and suppress weeds.
- The plants should be watered at an early on to improve survival and growth rates.
- Cutting the tree at a height of 1–1.5 m provides good biomass.
- The plant can be harvested two-three times a year, depending on growing niches and management practices.

Utilization of tree lucerne

- In a well-managed farm, the plant can be harvested and used as an animal feed with nine months of planting.
- The lucerne tree can produce more than 4–7 ha-1 of dry biomass year-1 under and when planted at 1 m x 1 m spacing.
- The leaf and edible branches of tree lucerne contain large amounts of crude protein (20–25%) and digestible organic matter (> 70%).
- The foliage of tree lucerne can be fed green or wilted or preserved in the form of hay and used as needed.
- A 1 kg supplement of dried tree lucerne leaf feed to a lactating dairy cow can give up to 1.2 liters of extra milk.
- A 300–400 g supplement of tree lucerne hay fed to a fattening sheep is enough to achieve a daily body weight gain of 70 g.
- Tree lucerne seeds serve as good sources of poultry feed.
- Tree lucerne flowers are a very good source of bee fodder.

Important tip

Household size, access to reliable water supply, and management factors—including fencing planted seedlings to protect from browsing, mulching during dry periods, clean spot weeding and applying organic fertilizers—significantly enhanced survival and growth of tree lucerne at the Africa RISING planting sites.

Photo 2. Farmers at the Endamehoni Africa RISING site, Tigray region, feeding tree lucerne to small ruminants (photo credit: ILRI/Kindu Mekonnen.

Fodder beet

Description

Fodder beet (*Beta vulgaris* subsp. Vulgaris L) is an annual/ biennial plant with thick roots and is cultivated in a cooler climate. The roots are a rich energy source for livestock. Fodder beet needs a long growing season (6–7 months), and rich soil to perform well. It grows in the highlands of Ethiopia (1800–3000 masl) with 750 mm rain and above. The high sugar content makes fodder beet palatable and a valuable energy source for ruminants and to some extent for pig.

Objective

To provide palatable and high energy feed for livestock with nutritive value equivalent to cereal grains.

Management

- Field preparation

A clean and well-prepared seed bed is required.

- Establishment

Fodder beet does better on light or medium soils to avoid harvest problems. The recommended seed rate is 5–10 kg/ha or use raised seedlings from nursery. Seeds can be row planted in June at 2 cm sowing depth and in rows 50 cm apart. Thinning can be done to give 20–25 cm spacing between plants or seedlings that can be transplanted from nurseries 1–2 months after planting.

- Fertilizer

Apply DAP at 100 kg/ha during establishment or about 10–15 t/ha of farmyard manure. Manure is very variable in quality and hence rates may vary depending upon soil types and previous cropping.

- Weeding and cultivation

Requires effective hand weeding especially during the early establishment period (the first one-two months). Hoeing and piling the soil around the roots is essential to facilitate increased root development and growth.

Performance

Fodder beet requires a lot of work, but rewards are high in terms of yield and animal performance. The average tuber yield is around 20 tons dry matter/ha. The leaves/tops will also contribute a further 3–4 tons dry matter/ha. Roots are high in energy (12-13 MJ ME/kg DM) but low in protein with crude protein values of 6-10%. It is highly digestible (70-80%). Tops (leaves) are relatively better in nutrient levels than bulbs(roots).

Seed production

Fodder beet flowers and produces seeds in the second year and the root decreases in size. When seed of fodder beet is ready for harvest, stripping is used for seed collection. Seed yield is about 400–500 kg/ha.

Utilization

The roots can be harvested after about 6 months from planting when they are at their maximum size. The roots are harvested carefully by digging them out of the ground. They need to be washed and separated from any soil material. In general, washed roots can be used for intensive management systems in dairy or fattening farms by chopping before feeding. Tops may also be fed after wilting. The tops can also be grazed or ensiled. Roots can be stored in the field (underground soil) or can be stored in stores after harvest for 4-5 months if not damaged during harvest.

Cows must be adapted to feeding the tuber gradually, by starting with a low level of an offer for the first time (e.g. 1 kg of tuber in the morning and 1 kg in the afternoon) and gradually increasing the amount of tuber provided over a week time. However, intake should not exceed 0.8% of the animal's live weight to avoid risk of acidosis. Feeding the fodder beets after the cows have been fed to other roughage feeds is advisable to reduce risk of potential toxicity if fed in the morning as a starter feed.

Limitations

- Porcupine damage can be a problem
- Not suited to water logging areas
- Declines in yield at low soil fertility
- It is susceptible to frost

Photo 3 Fodder beet grown under farmers condition and ready for use (Photo credits: ILRI/Aberra Adie)

Sweet lupine (*Lupinus albus*) as a feed and food crop

Description

Sweet lupine is a leguminous crop that was recently introduced to Ethiopia. As opposed to the local bitter lupine variety—which has high alkaloid content—sweet lupine has minimal levels of secondary metabolites, and the grain's crude protein content is high (35%); this makes it suitable for use as food and feed. As a legume crop, it contributes to soil fertility and can serve as a rotation crop, especially in areas where disease affecting pulse crops, such as faba bean, has become a serious problem.

Growing sweet lupine

- Sweet lupine varieties, such as Sanabor and Vitabor, released by Amhara Agricultural Research Institute through the national system have been found to perform very well at the Africa RISING research sites.
- While sweet lupine varieties are generally susceptible to water logging and do not grow well on vertisols, they tolerate soil acidity.
- Farmers can grow sweet lupine as a sole crop or intercrop it with maize.

Land preparation and sowing

- Sweet lupine has a slow initial root establishment period. To compensate for that, the land needs to be prepared well through repeated ploughing (at least twice).
- Water drainages should be established to ensure that run-offs do not negatively impact the sweet lupine plot.
- A seed rate of 80 kg/ha is generally recommended. In the case of row planting, the nationally recommended spacing is 30 cm between rows and 7 cm between plants.

However, with a high germination rate (above 90%), the spacing between plants can be increased to 15 cm.

- Initial fertilizer application equivalent to 100 kg DAP/ha may be applied. As a legume crop, sweet lupine fixes nitrogen and does not need additional fertilization at later stages.
- Mid-July is a suitable period for planting sweet lupine.

Weeding

- Ideally, the crop should be weeded twice during the growth cycle, the first time after full emergence, and the second just before the plant flowers.

Harvesting

- The crop reaches gain harvesting stage around the end of December. When mature, sweet lupine pods tend to shatter. It is, therefore, important to closely monitor sweet lupine fields and harvest the pods as they mature.

Yield and uses

- Sweet lupine yields up to three tonnes of grain/ha, and eight tonnes of haulm/ha.
- The grain is a very good protein and energy supplement for fattening animals.
- Supplementation of 200 g of sweet lupine grain daily to fattening sheep results in a daily body weight gain of about 75 g. The grain can effectively replace commercial concentrate supplements and help farmers finish fattening their animals using a farm grown energy and protein diet.
- Like other pulse crops, such as the faba bean and field pea, it can be used for human consumption. Mixed one–one with field pea grain, the Shiro from the grain has been very well received by farmers in north western Ethiopia.
- The grain can be processed into various products in the same way as soya bean.
- Generally, integrating sweet lupine into the mixed farming system provides multiple functions—ranging from soil fertility improvement to animal feed supplements and human food resources.

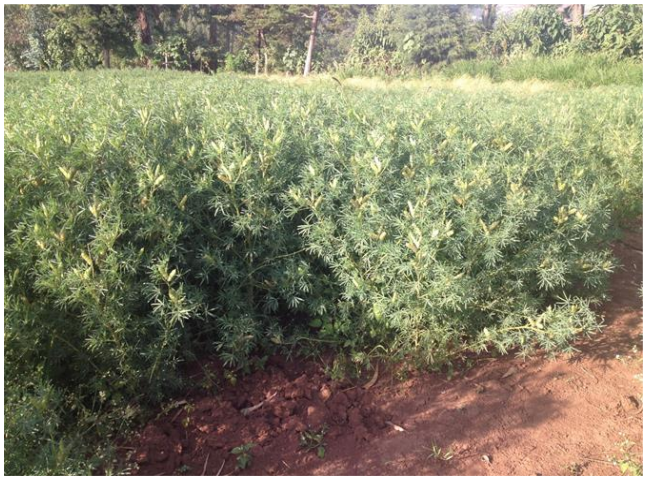

Photo 4 Sweet lupin field and sweet lupin grain (Photo credits: ILRI/Melkamu Bezabih)

Lablab (Lablab purpureus)

Description

Lablab is a leguminous annual or short-lived perennial fodder crop with a very good potential to provide high quality feed for livestock in midland areas and lowland drylands. Lablab is suitable for intercropping with other food crops such as maize and growing under perennial crops. The forge has large leaves, white flowers and light brown seeds. It is fast growing and produces fodder in three months and tolerates drought and cool temperatures. As a legume, it restores soil fertility. It can be used for grazing or cut and carry feeding system.

Management

- Field preparation—well prepared and ploughed field
- Establishment—broadcast seed at 30 kg/ha at 3 cm depth and cover
- Fertilizer—apply 100 kg DAP or manure per hectare
- Weeding—slow early growth so weed once after the third weeks after establishment
- Harvesting—at flowering after about three months

Performance

On average about 30 t/ha fresh forage can be harvested, which can be wilted or used as cut and carry. Protein content of the forage is about 18%

Limits of use

- Not adapted to areas with waterlogging
- Not adapted to areas with frost
- Not adapted to high rainfall areas
- Not good for hay making
- Causes bloat if fed in large quantities as green fodder

Photo 5 Lablab forage in demonstration sites in Angacha district (Photo credits: ILRI/ Melkamu Bezabih)

Alfalfa (Medicago sativa)

Description

Alfalfa is a perennial 1egume that can remain productive for over a decade with good management. It has a deep tap root system that enables the crop to extract moisture deeper soil layers and withstands frost. It has mainly purplish flowers, but also yellow colored cultivars are available. Pods of alfalfa range from the sickle type to those that are twisted into spirals. Each pod contains several small kidney-shaped seeds. New growth occurs from buds in the crown. Leaves are alternately arranged on the stem and are normally trifoliate. Alfalfa is highly palatable with high levels of protein. It is a highly suitable crop for conservation as hay or silage and can be grazed.

Adaptation

Alfalfa grows best on deep, well-drained, friable soils. Lands subject to frequent overflows or high-water tables are unfavorable for alfalfa. The pH of the soil should be 6.5 or above. It can grow well in cool highlands and warm lowlands of Ethiopia

Establishment

- A seedbed must be smooth, firm, free of weeds and trash, and contain adequate moisture for germination and emergence. Seeds can be broadcast or drilled in rows or on ridges 50 to 70 cm apart at 8 to 10 kg/ha
- Fertilizer—apply 100 kg DAP per hectare
- Weeding—weeding is essential in establishment stage and crop requires frequent cultivation
- Harvesting—harvested for hay by cutting at 5 cm height at first flowering

Performance

About 20 t/ha dry matter per year from about 6 to 8 cuts in well managed stands. Protein content of the forage is usually from 20–25% with digestibility of about 70%

Limits of use

- Not tolerant of continuous grazing
- Poor drought tolerance and require water for year-round production
- Not very tolerant to acidic soils and waterlogging
- Susceptible to many pests and diseases
- Bloat in livestock is the major limitation to grazing alfalfa

Desho grass (Pennisetum pedicellatum)

Description

Desho is an indigenous grass belonging to the family of Poaceae. It is a perennial grass that has an extensive root system that anchors well with the soil. It produces high biomass (10-20-ton DM/ha) with a potential of 2-4 times cutting with rainfed production and up to 9 times cutting using irrigation per year. It grows upright with the potential of reaching 90–

120 cm based on soil fertility. It can grow anywhere from 1500–2800 masl with optimum elevation over 1700 masl on medium to low soil fertility.

Uses:

- For a year-round livestock fodder
- For erosion control through strip planting
- To rehabilitate degraded land
- To improve grazing land management
- As silage or hay for dry season feed

Land preparation and planting:

- Desho needs very good land preparation
- Splits of grass from root clump can be used as planting material
- Grass clumps should be uprooted and split into several splits
- Stem cutting of matured plant that has ≥ 3 nodes can also be used as planting material
- Recommended to plant at 10 cm by 10 cm intervals along bunds for SWC
- Recommended to plant at 50 cm by 50 cm intervals for grazing land management
- Remove the leafy part before planting to reduce competition before it establishes well
- Open the soil with hoes and place the split in the soil before pressing the basal soil around the seedling

Fertilization:

- Compost/manure of about 4500 kg/ha for establishment and 1000 kg for maintenance
- Use about 100 kg/ha of fertilizer for establishment and 25 kg for maintenance

Harvesting:

- Cut and carry system is encouraged
- Should be harvested at 8 cm high from ground level
- Highest yield can be obtained if first harvested at 4 months after planting

Economics of production:

- Desho provides a small business opportunity for Ethiopian farmers (sale of the cut and planting materials)
- The use of Desho for feed and land management is increasing rapidly

Limitations for wider adoption:

- The grass rarely seeds, and propagation is mainly through root splits

- The establishment and maintenance of Desho requires intensive labour
- Susceptible to intensive free grazing practice

Photo 6 Desho grass (Photo credits: ILRI/Melkamu Bezabih)

Brachiaria hybrid cv. Mulato II

Description

Mulato II is a leafy, vigorous, semi-decumbent perennial grass of medium height, growing to between 80–100 cm without inflorescences. It is a very leafy plant with 5–8 leaves (length 40–60 cm, width 0.6–0.7 cm) per stem. The intense green leaves are strongly pubescent on both sides of the leaves. Pubescens on the cylindrical stems are weak. It is recommended for regions with acid soils of medium to low fertility, medium periods of drought, high temperatures. It does not tolerate high water logging. It is highly palatable and has a good level of protein and soluble carbohydrates.

Seedbed preparation

Brachiaria would require a well-prepared seedbed. Due to the small seeds. A fine seedbed would be preferable. As for most crops, seedbedpreparation should be done well before the rains for ease of preparation and killing of weeds. If the piece of land is prone to obnoxious weeds, e.g., couch grass, herbicide spraying is advisable to systematically control these weeds. Plough to about 25 cm depth and harrow the land to obtain a fine soil tilth necessary for seeds that are small. Preferably avoid sloping and uneven land for lay the plots and minimize likely variations in performance.

Establishment

Mulatto II (and also other brachiaria grasses) does not bear viable seed under the Ethiopian climatic conditions. So, the main mechanism of propagation, unless seeds are sourced from outside of the country, is through root splits and cuttings. Root splits are planted in a row (40-50 cm between rows and 20 -25 cm between plants).

If seeds are available, it can be either planted in rows, 40–50 cm apart (8 kg /ha) or broadcasted sown at 10–12 kg/ha. For drilling through seed drills, be very careful not to bury the seed more than 2 cm in depth. Roller drills are preferred because they do not bury the seed too deeply, but instead press the seed just below the soil surface. For broadcast sowings, seed can be spread mechanically or hand sown. The seed must be covered after sowing by harrows. On small areas, tree branches or large brooms can be used to lightly cover the seeds with soil. Be careful not to bury the seed no more than 1–2 cm under the soil. Seeding can be started after 30 mm of rainfall.

Fertilization

After fertilizer application during planting (for the initial fertilization use a phosphorus dominated fertilizer to support root development – DAP), subsequent applications should be annually with nitrogenous fertilizer at a rate of 100 kg/ha of urea. Application should be done after rains and the soils is wet enough to dissolve the fertilizer. Preferably, application should be after harvesting and the soils are wet, for the regrowth.

Management

Brachiaria will take 70–80 days till the first cut. In rotation the following cuts can be done after 25– 45 days while rainy season respectively 60–70 while dry season.

Photo 7 Mulato II grass (Photo credit: ILRI/ Aberra Adie)

Napier or elephant grass (*Pennisetum purpureum*)

Description

A very tall perennial grass which tends to become coarse as it matures. It Has vigorous deep-rooted grass which tolerates limited dry spells. It tolerates poor drainage and is good for soil stability and as a wind break. It is a fast growing and good palatability in early growth stage if cut often. It is useful for cut and carry, hay or silage.

Establishment

Napier is mainly established using cuttings. Cuttings are taken from the basal 2/3 of moderately mature stems and each cutting should contain at least 3 nodes. These are pushed into the soil at 45º, basal end down, with 2 nodes buried. Cuttings can also be planted horizontally into a furrow, to a depth of 5-10 cm. Normally planted in rows 0.5m - 1m apart and 0.5 cm apart between plants. Closer spacing is required for soil conservation contour hedgerows and for high rainfall environments. More open spacing is used in drier environments.

Fertilizer

Should be planted into fertile soil. Once established, requires, 150-200 kg/ha/yr N, together with other nutrients as indicated by soil tests. Responses at much higher levels of applied N have been obtained. Yields decline rapidly if fertility is not maintained.

Dry matter

Yields depend on fertility, moisture, temperature and management. DM yields of 10-30 t/ha/yr are common, (and up to 85 t/ha/yr) if well fertilized. More frequent cuts (up to 45 days) give less dry matter, but better leaf production than infrequent cuts.

Limits of use

- Not adapted to areas with frost
- Not suited to waterlogged areas
- Will not persist without fertilizer
- Coarse, fibrous and sharp leaves if not cut frequently

Photo 8 Napier grass intercropped with Silver leaf Desmodium (Photo credits: ILRI/ Aberra Adie)

Improved feeding management

As feed is the main cost of livestock production, it is essential that available feed resources are used for feeding livestock in an optimal way. Among several measures that need to be taken to optimize feed utilization, the first one is to minimize postharvest losses during feeding and storage. Feeding troughs and feed storage sheds play an important role in minimizing feed wastage. The other important measure is to mix feed ingredients in a proportion that can supply a balanced ration for livestock. In this regard, feed troughs also play an important role because mixing can be done easily, and animals can be offered mixed diets on feeding troughs conveniently. Therefore, it is highly advisable that individual farmers construct their own feed storage sheds for dried feed stuffs including crop residues and hay and feeding troughs for cattle and small ruminants. Traditional practices of chopping cultivated fodders, stovers and leaves before feeding also contribute to increasing feed intakes, minimizing wastages and easing mixing of different feeds.

Feed troughs

Description

Traditionally, dried feed resources—such as hay and crop residues—are stored as heaps in the open air and feeding takes place by spreading a portion on the ground. These management practices are associated with considerable loss of feed biomass and quality as a result of weather, pests, contamination and moulding. Moreover, in a cut-and carry feeding system—where fresh cultivated forages form the basic component of animal diets—

traditional feeding practices incur feed biomass wastage due to trampling and defecation on the feed.

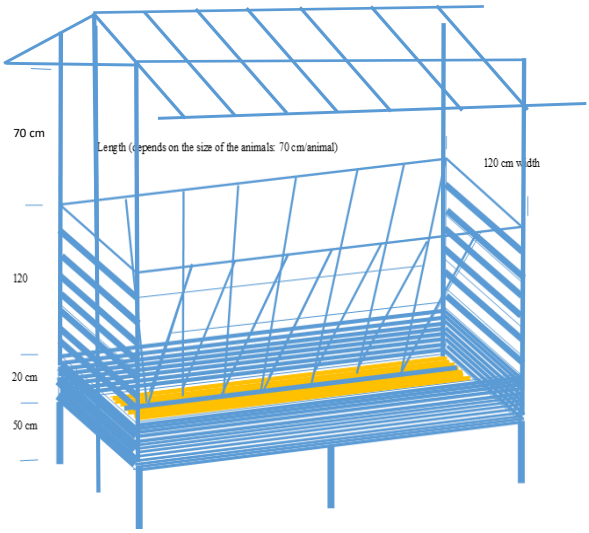

Figure 1. Specification for two-sided feeding trough for mature zebu

Photo 9 A two-sided feeding trough prototype for cattle (photo credits: ILRI/Kindu Mekonnen)

Specifications

- Feeding troughs and storage sheds can be constructed from locally available materials; nails are the main external inputs required.
- Depending upon where the trough is placed, it can be either one- or two-sided.

- A two-sided feeding trough is desirable if it is to be located in the middle of a barn or backyard.

- A one-sided feeding trough is convenient if it is to be attached to a wall of a barn or house.
- In line with the size specification indicated in figures 1 and 2, the length of the trough depends upon the number of animals feed on it, allowing for a 70 cm per animal spacing requirement. For instance, a two-sided trough for four animals needs to be 1.4 m long, while one-sided trough for the same animals should be 2.8 m long.
- Adding a roof for feeding trough is optional and can be done using locally available materials (grass mat), or plastic and corrugated iron sheets, depending on the capacity of the farmers.

Storage sheds

- As a basic requirement, all sheds should be built with a roof and a raised floor platform to avoid spoilage from above and below.
- The floor needs to be raised 30–40 cm from the ground and aerated with the regular cleaning of the surface underneath. This ensures that the floor is protected from mould and rodent infestation.
- The size of the shed depends on the amount of feed (crop residues and hay) that need to be stored there. It is generally recommended that on average a farmer should build a shed of at least 4 m by 3 m to store his or her feed resources safely.

Benefits

- The evaluation results showed that use of a combination of feed troughs and storage sheds saves individual farmers from 30–50% of feed biomass that would be otherwise wasted.
- The labour requirement for feeding is reduced by a minimum of 10–20% due to use of feeding troughs.
- The sensory quality of crop residues and hay is preserved static when stored in sheds, opposed to when it is stored in heaps in the open air.
- The cost incurred in the construction of feeding troughs is recovered within a year, while that of storage sheds within three–four years.

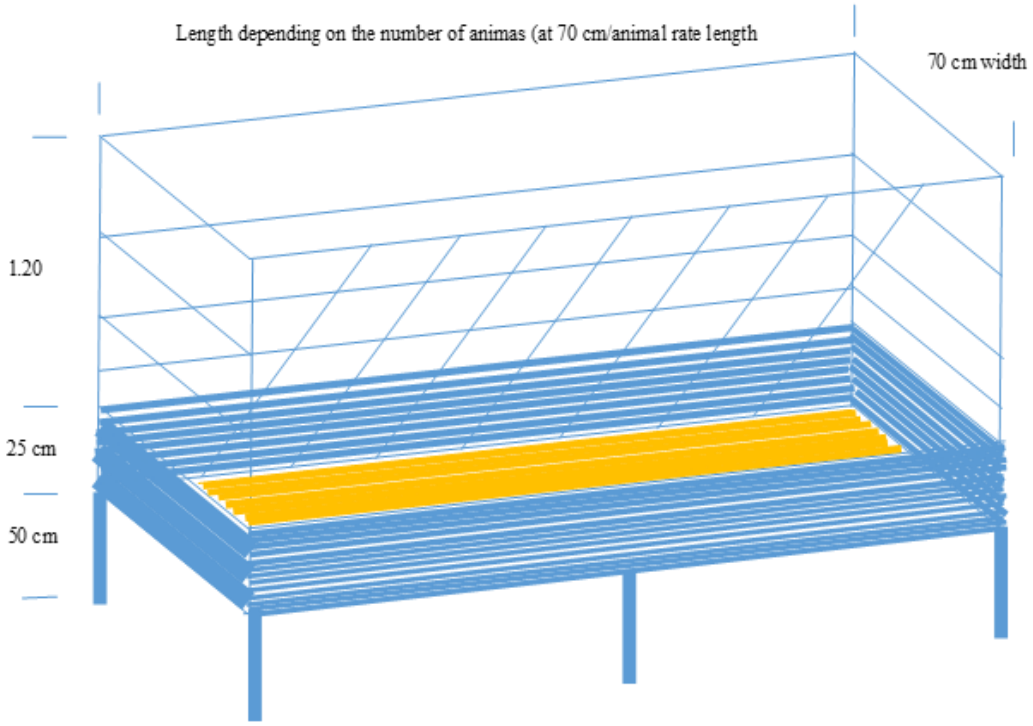

Figure 10. A one-sided feeding trough design for cattle

Important web links

1. www.ilri.org
2. https://cgspace.cgiar.org
3. https://www.feedipedia.org
4. https://africa-rising.net
5. http://www.tropicalforages.info/